

**State of California
Office of Administrative Law**

In re:
Department of Water Resources

Regulatory Action:

Title 23, California Code of Regulations

Adopt sections: 335, 335.2, 335.4, 335.6,
335.8, 335.10, 335.12,
335.14, 335.16, 335.18,
335.20

**NOTICE OF APPROVAL OF EMERGENCY
REGULATORY ACTION**

**Government Code Sections 11346.1 and
11349.6**

OAL Matter Number: 2017-1009-03

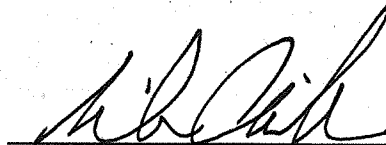
OAL Matter Type: Emergency (E)

This emergency rulemaking by the Department of Water Resources establishes criteria for dam owners to prepare and submit inundation maps for review pursuant to Water Code sections 6160, 6161, and 6162 (added by Stats. 2017, ch. 26, § 88 (SB 92)).

OAL approves this emergency regulatory action pursuant to sections 11346.1 and 11349.6 of the Government Code.

This emergency regulatory action is effective on 10/19/2017 and will expire on 4/18/2018. The Certificate of Compliance for this action is due no later than 4/17/2018.

Date: October 19, 2017



Nicole C. Carrillo
Attorney

For: Debra M. Cornez
Director

Original: Grant Davis
Copy: Michael Waggoner

NOTICE PUBLICATION/REGULATIONS SUBMISSION

(See instructions on reverse)

STD. 400 (REV. 01-2013)

OAL FILE NUMBERS	NOTICE FILE NUMBER Z-	REGULATORY ACTION NUMBER	EMERGENCY NUMBER 2017-1009-03E
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For use by Office of Administrative Law (OAL) only

For use by Secretary of State only

ENDORSED - FILED

in the office of the Secretary of State
of the State of CaliforniaOCT. 19 2017
1:50 P.M.2017 OCT -9 AM:10
OFFICE OF
ADMINISTRATIVE LAW

NOTICE

REGULATIONS

AGENCY WITH RULEMAKING AUTHORITY
Department of Water Resources

AGENCY FILE NUMBER (if any)

A. PUBLICATION OF NOTICE (Complete for publication in Notice Register)

1. SUBJECT OF NOTICE		TITLE(S)	FIRST SECTION AFFECTED	2. REQUESTED PUBLICATION DATE
3. NOTICE TYPE <input type="checkbox"/> Notice re Proposed Regulatory Action <input type="checkbox"/> Other		4. AGENCY CONTACT PERSON	TELEPHONE NUMBER	FAX NUMBER (Optional)
OAL USE ONLY	ACTION ON PROPOSED NOTICE <input type="checkbox"/> Approved as Submitted <input type="checkbox"/> Approved as Modified <input type="checkbox"/> Disapproved/Withdrawn		NOTICE REGISTER NUMBER	PUBLICATION DATE

B. SUBMISSION OF REGULATIONS (Complete when submitting regulations)

1a. SUBJECT OF REGULATION(S) Inundation Maps		1b. ALL PREVIOUS RELATED OAL REGULATORY ACTION NUMBER(S)
2. SPECIFY CALIFORNIA CODE OF REGULATIONS TITLE(S) AND SECTION(S) (Including title 26, if toxics related)		
SECTION(S) AFFECTED (List all section number(s) individually. Attach additional sheet if needed.)		ADOPT 335, 335.2, 335.4, 335.6, 335.8, 335.10, 335.12, 335.14, 335.16, 335.18, 335.20
TITLE(S) 23		AMEND
3. TYPE OF FILING		REPEAL
<input type="checkbox"/> Regular Rulemaking (Gov. Code §11346) <input type="checkbox"/> Resubmittal of disapproved or withdrawn nonemergency filing (Gov. Code §§11349.3, 11349.4) <input checked="" type="checkbox"/> Emergency (Gov. Code, §11346.1(b))		
<input type="checkbox"/> Certificate of Compliance: The agency officer named below certifies that this agency complied with the provisions of Gov. Code §§11346.2-11347.3 either before the emergency regulation was adopted or within the time period required by statute. <input type="checkbox"/> Resubmittal of disapproved or withdrawn emergency filing (Gov. Code, §11346.1)		
<input type="checkbox"/> Emergency Readopt (Gov. Code, §11346.1(h)) <input type="checkbox"/> File & Print <input type="checkbox"/> Other (Specify) _____		
<input type="checkbox"/> Changes Without Regulatory Effect (Cal. Code Regs., title 1, §100) <input type="checkbox"/> Print Only		
4. ALL BEGINNING AND ENDING DATES OF AVAILABILITY OF MODIFIED REGULATIONS AND/OR MATERIAL ADDED TO THE RULEMAKING FILE (Cal. Code Regs. title 1, §44 and Gov. Code §11347.1)		
5. EFFECTIVE DATE OF CHANGES (Gov. Code, §§ 11343.4, 11346.1(d); Cal. Code Regs., title 1, §100)		
<input type="checkbox"/> Effective January 1, April 1, July 1, or October 1 (Gov. Code §11343.4(a)) <input checked="" type="checkbox"/> Effective on filing with Secretary of State <input type="checkbox"/> \$100 Changes Without Regulatory Effect <input type="checkbox"/> Effective other (Specify) _____		
6. CHECK IF THESE REGULATIONS REQUIRE NOTICE TO, OR REVIEW, CONSULTATION, APPROVAL OR CONCURRENCE BY, ANOTHER AGENCY OR ENTITY		
<input type="checkbox"/> Department of Finance (Form STD. 399) (SAM §6660) <input type="checkbox"/> Fair Political Practices Commission <input type="checkbox"/> State Fire Marshal <input type="checkbox"/> Other (Specify) _____		
7. CONTACT PERSON Michael Waggoner	TELEPHONE NUMBER (916) 227-9800	FAX NUMBER (Optional) E-MAIL ADDRESS (Optional) mapregs@water.ca.gov

8. I certify that the attached copy of the regulation(s) is a true and correct copy of the regulation(s) identified on this form, that the information specified on this form is true and correct, and that I am the head of the agency taking this action, or a designee of the head of the agency, and am authorized to make this certification.

SIGNATURE OF AGENCY HEAD OR DESIGNEE

DATE

9.12.17

TYPED NAME AND TITLE OF SIGNATORY

Grant Davis, Director

For use by Office of Administrative Law (OAL) only

ENDORSED APPROVED

OCT 19 2017

Office of Administrative Law

NOTE: All of the proposed regulation text is to be added to the California Code of Regulations.

**California Code of Regulations
Title 23. Waters
Division 2. Department of Water Resources
Chapter 1. Dams and Reservoirs
Article 6. Inundation Maps**

§ 335. Scope of Regulations

Inundation maps shall be prepared for dams and critical appurtenant structures regulated by the state, except dams classified by the department as low hazard as described in Section 335.4. The regulations in this article apply to inundation maps and supporting technical studies necessary to develop the maps. Owners are responsible for preparing and submitting these documents to the department.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Sections 6002, 6160 and 6161, Water Code.

§ 335.2. Definitions

For purposes of this Article, the terms listed below shall have the meanings noted:

- (a) “Breach” refers to a sudden opening through a dam system that drains the reservoir.
- (b) “Breach elevation” refers to the elevation of the water in a reservoir at full reservoir conditions.
- (c) “Breach time” refers to the modeled time elapsed from initial dam failure to total dam failure.
- (d) “Critical appurtenant structure” refers to a man-made barrier or hydraulic control structure that impounds the same reservoir as the dam and is 25 feet or more in height; impounds a minimum of 5,000 acre-feet of water at full reservoir conditions; or has the potential to inundate downstream life or property, including but not limited to emergency spillways, gated spillways, and saddle dams. The height of a critical appurtenant structure shall be determined as follows: saddle dams shall be measured from the downstream toe to the maximum water storage elevation; all other critical appurtenant structures shall be measured from the upstream toe to the maximum water storage elevation.

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A critical appurtenant structure may contain multiple water-barrier features, including but not limited to gates, flashboards, and concrete monoliths. Power system penstocks, lined spillway chutes, and low level outlets whose failure would not exceed the downstream channel capacity are not considered critical appurtenant structures as they pertain to inundation maps.

(e) “Critical facilities” refers to lifeline infrastructure and facilities including but not limited to schools, hospitals, skilled nursing facilities, major roads, public water and electric utilities, and communication infrastructure, as described in Section 8589.5 of the Government Code.

(f) “Cross-section” refers to a linear representation perpendicular to a watercourse and its adjacent floodplain, capturing the topography perpendicular to the flow direction.

(g) “Dam system” refers to a dam and all critical appurtenant structures that impound the same reservoir.

(h) “Deflood time” refers to the time elapsed from the flood wave arrival time until water at the measured location recedes to within one foot of its preflood water elevation.

(i) “Dynamic routing” refers to hydraulic flow routing based on the shallow water equations to compute changes in discharge, velocity, and stage with respect to time at various locations along a watercourse. The most common form of the equations is the Saint-Venant equations.

(j) “Failure scenario” refers to the modeled simulation of a complete failure of a dam or critical appurtenant structure which results in the uncontrolled release of water.

(k) “FEMA P-946” refers to the “Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures” dated July 2013, hereby incorporated by reference.

(l) “Flood surcharge” refers to the volume in a reservoir above the maximum certified water storage elevation resulting from a storm event.

(m) “Flood wave arrival time” refers to the elapsed time from the initiation of the failure scenario until the arrival of the leading edge of the flood wave comprising a one (1) foot rise above the ground elevation or water surface elevation before the failure scenario.

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- (n) “Freeboard” refers to the vertical distance between the lowest point along the top of a dam, dike, berm, levee, or other similar feature and the surface of the water contained therein.
- (o) “Full reservoir conditions” refers to the maximum water storage elevation authorized in the department’s Certificate of Approval for the dam.
- (p) “Hydraulic model” refers to a simulation of conveyance of water through a watercourse.
- (q) “Hydrologic model” refers to a simulation of watershed processes such as precipitation, infiltration, and runoff. Hydrologic models perform simplified forms of dynamic routing.
- (r) “Inundation area” refers to the area that would experience a rise in water surface elevation of at least one (1) foot as the result of a failure scenario.
- (s) “Inundation map” refers to a map showing the area that would result in flooding from a failure scenario.
- (t) “One-dimensional model” refers to a numerical hydraulic model in which variables such as velocity and depth vary in one direction along a watercourse.
- (u) “Peak flow” refers to the maximum rate of water discharge.
- (v) “River mile” refers to the distance from a fixed point along a watercourse, measured along the thalweg.
- (w) “Sequential dam failure” refers to a failure scenario of an upstream dam system that results in the failure of one or more downstream dam systems.
- (x) “Storm-induced failure” refers to a failure scenario in which the extent of the inundation area is greater than that of a sunny day failure scenario.
- (y) “Sunny day failure” refers to a failure scenario of the dam system during full reservoir conditions with non-flood season inflow.
- (z) “Thalweg” refers to the line connecting the lowest point of a watercourse.
- (aa) “Toe” refers to the junction of the slope of a dam or critical appurtenant structure with the natural ground surface.
- (bb) “Two-dimensional model” refers to a numerical hydraulic model in which variables such as velocity and depth vary in two directions along a watercourse.

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(cc) “Watercourse” refers to a stream or open conduit, including but not limited to canyons and floodplains.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 8589.5, Government Code; Sections 6002, 6002.5, 6004.5, 6005, 6008 and 6161, Water Code.

§ 335.4. Hazard Potential Classification

The department shall classify the public safety risk of all state jurisdictional dams as follows:

- (a) Low Hazard Potential. Dams assigned the low hazard potential classification are those where failure or mis-operation of the dam system would result in no probable loss of human life and low economic and/or environmental losses. Losses are expected to be principally limited to the owner’s property.
- (b) Significant Hazard Potential. Dams assigned the significant hazard potential classification are those dams where failure or mis-operation of the dam system would result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or other significant impacts.
- (c) High Hazard Potential. Dams assigned the high hazard potential classification are those where failure or mis-operation of the dam system will probably cause loss of human life.
- (d) Extremely High Hazard Potential. Dams assigned the extremely high hazard potential classification are dams that would otherwise be classified as high hazard dams, but where failure or mis-operation of the dam system would probably cause considerable loss of human life and would affect an inundation area with a population of 1,000 persons or more, or where critical facilities could be impacted.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6002.5, 6009, 6160 and 6161, Water Code.

§ 335.6. Inundation Map Updates

The owner of a dam shall update all inundation maps for the dam system under each of, but not limited to, the following circumstances:

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- (a) The department determines there is a significant change in the dam or critical appurtenant structure.
- (b) There is a significant change in downstream development that involves people and property.
- (c) The department changes the hazard classification of the dam.
- (d) No less frequently than every 10 years.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6006, 6007 and 6161, Water Code.

§ 335.8. Civil Engineering

Inundation maps and technical studies shall be prepared by, or under the direction of, a civil engineer who is registered pursuant to California law and authenticated as provided in the Business and Professions Code, Division 3, Chapter 7 commencing with Section 6700.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6161, Water Code; Section 6700, Business and Professions Code.

§ 335.10. Reporting Standards

Inundation maps and technical studies prepared in accordance with this Article shall utilize the following standards and conventions, unless otherwise indicated:

- (a) Reservoir storage and other water volumes shall be reported in acre-feet.
- (b) Water discharge shall be reported in cubic feet per second.
- (c) Geographic locations shall be reported in California Coordinate System or Universal Transverse Mercator coordinates relative to NAD83. Coordinates shall be specified commensurate with the precision of the analysis.
- (d) Elevations shall be reported in feet above a specified vertical datum such as NAVD88 or NAVD29. Elevations may also be reported relative to an established local datum.

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(e) Geospatial data shall be submitted in NAD 1983 Teale (California) Albers projection, with the units specified.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6161, Water Code.

§ 335.12. Technical Study

A single technical study shall be prepared for each dam system for which inundation maps are required.

(a) Study contents. The technical study shall include the following:

- (1) The name of the dam, department dam number, national dam ID number, and name or description of any critical appurtenant structures.
- (2) The location of the dam and all critical appurtenant structures.
- (3) The name and location of cities, towns, counties, and any populated area that could be affected by a failure scenario.
- (4) A brief narrative of the hydrologic, meteorologic, and topographic features of the watershed, dam site, and downstream areas.
- (5) An engineering description of the dam, including the type of construction (e.g., earth, rock, or concrete). Include a description of the features comprising each critical appurtenant structure (i.e., a description of all the gates and concrete structures comprising a gated spillway structure).
- (6) Elevation of the crest and upstream toe for the dam and each critical appurtenant structure. Report the elevation of the downstream toe of the dam.
- (7) A reservoir storage capacity curve that shows the relationship between reservoir elevation, surface area, and volume from the base of the reservoir to the dam crest.
- (8) A spillway rating curve that shows the relationship between stage and discharge.
- (9) The type of terrain data used, including any modifications made to the terrain.

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(10) A summary of the modeled failure scenarios for the dam system. For each failure scenario, include the breach hydrograph immediately downstream of the dam or critical appurtenant structure.

(11) The modeling methodology, the reasons for its use, and the name, version, release date and author of the modeling software. Report all assumptions, failure parameters, calibration and sensitivity analyses of the model, including the model's response to changes made to the roughness or other friction coefficients. Report modifications made to stabilize the model or accelerate its computational runtime, and the effects such modifications have on the modeled inundation results. Describe known limitations of the modeling method utilized. Provide justification for determining the downstream extent of the inundation boundary.

(12) Digital files comprising the following for each failure scenario:

(A) A vector file of the inundation area boundary.

(B) Raster files of the flood wave arrival time, maximum depth, peak velocity, and deflood time.

(13) The department may request additional information during the course of its review.

(b) Modeling Requirements.

(1) A two-dimensional, open channel, unsteady flow, hydraulic model shall be used to evaluate each failure scenario for a dam system, except as described below. The model must be capable of performing dynamic routing to approximate the temporal and spatial changes in inundation magnitude and extent.

(2) A one-dimensional hydraulic model may be used that is capable of computing spatial and temporal changes to water surface elevation, velocities, and flows at each cross section. A one-dimensional model may be used only in the following circumstances:

(A) To simulate levee overtopping as a subcomponent of the two-dimensional model of the failure scenario.

(B) Where the flood wave would be confined to a canyon or narrow watercourse in which the direction of flow is dominantly in the downstream direction.

(3) Upon approval of the department, the owner of a significant hazard dam may use a hydrologic model, rather than a hydraulic model, if the dam impounds less than 100 acre-feet of water and the flood wave produced by the failure scenario would be confined to a

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canyon or narrow watercourse in which the direction of flow is dominantly in the downstream direction.

(4) Each model shall utilize the best available terrain data, consisting of the finest resolution discretization available.

(c) Failure Scenarios. A sunny day failure scenario is required for each dam and critical appurtenant structure. A storm-induced failure scenario is not required, but may be submitted in lieu of a sunny day failure scenario.

Each failure scenario shall employ a complete and nearly instantaneous loss of the dam or critical appurtenant structure, and utilize breach parameters as described in FEMA P-946 (2013). The geographic extent of the model simulation shall terminate in accordance with FEMA P-946 (2013). Failure scenarios shall be modeled as follows:

(1) For gated critical appurtenant structures, such as a spillway with multiple radial gates, the failure scenario shall consist of the complete failure of all gates together with the concrete control section breached to the upstream toe.

(2) A sequential dam failure scenario is required for an upstream dam system that causes the failure of one or more downstream dam systems, as described in FEMA P-946 (2013). A sequential dam failure scenario shall employ an overtopping failure mode for all downstream dam systems impacted by the routing of the flood wave downstream. The owner of the upstream dam system is responsible for preparing the sequential failure scenario.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6161, Water Code.

§ 335.14. Inundation Maps

Inundation maps shall be prepared for each failure scenario to satisfy the FEMA P-946 (2013) and the requirements of this section.

(a) Temporal contours. Two separate inundation maps shall be prepared for each failure scenario, with contours depicting time increments appropriate for the failure scenario for flood wave arrival time and deflood time.

(b) Depth grid. All inundation maps shall depict the entire inundation area with discrete categories of maximum flood wave depths, with a legend showing each depth range. The opacity of the maximum flood wave depth layer shall be adjusted to display the underlying base map.

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(c) General information. Each inundation map shall contain the following general information:

- (1) The name of the dam, the department's dam number, the national dam ID number, and the county in which the dam is located.
- (2) The failure scenario. If a storm-induced failure scenario is depicted, the return period shall be reported on the inundation map.
- (3) The map background with suitable aerial imagery.
- (4) Callouts identifying the location of the dam, all critical appurtenant structures, and all critical facilities affected by the failure scenario. The downstream watercourse and flood control features, such as dams, levees, weirs, pumps, and control structures shall be labeled.
- (5) The identity of any jurisdictions, including boundary delineations or place marks identifying the city, county, or other governmental agency jurisdictional boundaries affected by the inundation area.
- (6) An arrow indicating north.
- (7) An appropriate scale bar and the stated map scale.
- (8) Vertical elevation datum.
- (9) Map collar information, including horizontal reference grid ticks.
- (10) An index showing the relationship of the map sheet to the other map sheets if the map has multiple sheets.
- (11) The date of preparation of the map.
- (12) The signature, seal, and licensed civil engineer number of the engineer responsible for preparing the map.
- (13) All features on maps shall be clearly labeled with text boxes and legends, as appropriate.
- (14) A statement that the information shown is approximate and should be used as a guideline for emergency response and preparation purposes.

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(15) A statement confirming the inundation map meets all applicable state and federal standards and has been prepared in consideration of all potential downstream hazards by a licensed civil engineer.

(d) Map Layout. Each of the inundation maps shall be printed on paper sized 11×17 inch or larger, with a minimum resolution of 300 dots per inch. All inundation maps shall apply an appropriate map scale as described in FEMA P-946 (2013). For failure scenarios with a large inundation area, each inundation map may comprise more than one sheet.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 8589.5, Government Code; Sections 6160 and 6161, Water Code.

§ 335.16. Submission of Inundation Maps and Technical Study

The owner of a dam shall submit inundation maps and the supporting technical study to the department as specified below:

(a) An electronic color copy of each new and revised inundation map in portable document format (PDF extension). If practical, two hard color copies of each inundation map should also be submitted.

(b) Technical Study: Two hard copies and an electronic copy including digital content.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6161, Water Code.

§ 335.18. Department Review and Approval

(a) The department shall evaluate each inundation map and technical study that is submitted for consistency with the requirements of this article and shall notify the dam owner in writing that the map and study have been approved, are incomplete, or are disapproved and the reasons therefor, as follows:

(1) Approved. The department has evaluated the inundation map(s) and technical study and determined that they satisfy the requirements of this article.

(2) Incomplete. The department has evaluated the inundation map(s) and technical study and determined that one or both do not satisfy the requirements of this article as a result of minor problems identified by the department. A dam owner shall remedy any deficiencies and submit the corrected map and study.

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(3) Disapproved. The department has evaluated the inundation map and technical study and determined that one or both do not satisfy the requirements of this article due to unresolved problems associated with an incomplete submittal. When an inundation map or technical study is disapproved, the dam owner shall submit a new map and technical study that satisfy this article.

b) Inundation maps submitted to the department for review by January 1, 2018, shall be evaluated for consistency with the FEMA P-946 (2013).

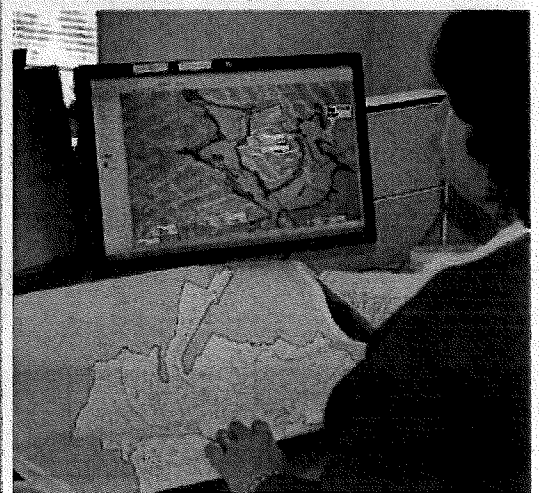
Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 8589.5, Government Code; Sections 6161 and 6431, Water Code.

§ 335.20. Public Availability of Inundation Maps

The department shall post copies of approved inundation maps on the department's website.

Note: Authority cited: Sections 6078 and 6162, Water Code. Reference: Section 6161, Water Code.

ADOPT



Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures

First Edition

FEMA P-946 / July 2013



FEMA